

MARISA PETRUSKY

NSF GRFP Fellow at Nonequilibrium Gas & Plasma Dynamics Laboratory.

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EDUCATION

University of Colorado Boulder

PhD Candidate, Aerospace Engineering Sciences

Boulder, CO

2021–Present

Thesis: *Kinetic Modeling of Plasma Electrostatics in Hypersonic Shock Layers.*

Master of Science in Aerospace Engineering Sciences, with Certificate in Hypersonics

2023

Stony Brook University

Bachelor of Science in Physics, with Honors

Stony Brook, NY

2021

Thesis: *Studying the Simulated Transverse Probing of Laser Wakefield Accelerators.*

RESEARCH EXPERIENCE

Nonequilibrium Gas and Plasma Dynamics Laboratory

Research Assistant

Boulder, CO

2021–Present

Projects: Study plasma electrostatics of atmospheric entry flows with discrete-velocity Boltzmann-BGK-Poisson kinetic solver, including:

- ◆ Maintain in-house Boltzmann-BGK-Poisson kinetic solver, including developing multiple code enhancements.
- ◆ Assess validity of the ambipolar diffusion approximation in rarefied flows.
- ◆ Evaluate impact of plasma sheath on vehicle surface convective heat flux.
- ◆ Determine general guidelines on which flight regimes are most impacted by plasma electrostatic effects.
- ◆ Developed novel numerical model for a 1D3V stagnation streamline for discrete-velocity methods.

Advisor: Iain Boyd

Analytical Mechanics Associates

NASA Ames Intern

Moffett Field, CA

Summer 2024

Project: Developed 1D viscous shock solving capabilities for DPLR for validation of NEQAIR chemical databases.

Plasma Accelerator Group

Undergraduate Research Assistant

Stony Brook, NY

2020–2021

Projects: Wrote 3D3V Quasi-static Electron Propagation (QuEP) Monte Carlo particle solver.

Developed proof of concept for experimental diagnostics of electron beam through laser-induced plasma wakefields using QuEP.

Lead (Pb-208) Radius Experiment (PREX) Collaboration

Undergraduate Research Assistant

Newport News, VA

2017–2019

Projects: Conducted study of angular and position dependency of flux in Cherenkov detectors.

Operated beam target and monitored data collection during experiment run time.

Wrote detector alignment software, verified by Monte-Carlo particle simulations.

JOURNAL PUBLICATIONS

3. D. Adihikari, et al. [The CREX Collaboration, including **M. Petrusky**]. Precision Determination of the Neutral Weak Form Factor of ^{48}Ca . *Physics Review Letters*, 129(4), 2022. DOI: 10.1103/PhysRevLett.129.042501
2. D. Adihikari, et al. [The PREX and CREX Collaborations, including **M. Petrusky**]. New Mea-

surements of the Beam-Normal Single Spin Asymmetry in Elastic Electron Scattering over a Range of Spin-0 Nuclei. *Physics Review Letters*, 128(14), 2022. DOI: 10.1103/PhysRevLett.128.142501

1. D. Adihikari, et al. [The PREX Collaboration, including **M. Petrusky**]. Accurate Determination of the Neutron Skin Thickness of ^{208}Pb through Parity-Violation in Electron Scattering. *Physical Review Letters*, 126(17), 2021. DOI: 10.1103/PhysRevLett.126.172502

PEER-REVIEWED CONFERENCE PROCEEDINGS

2. **M. Petrusky**, I.D. Boyd. Evaluation of the Ambipolar Diffusion Approximation using an Eulerian Boltzmann-Poisson-BGK Solver. *Proceedings of the 33rd International Symposium on Rarefied Gas Dynamics, Springer Aerospace Technology*, 2025. *Accepted*.
1. I. Petrushina, R. Zgadza, **M. Petrusky**, et al. Characterization of the Fields Inside the CO₂-Laser-Driven Wakefield Accelerators using Relativistic Electron Beams. *2022 IEEE Advanced Accelerator Concepts Workshop (AAC)*, 1–6, 2022. DOI: 10.1109/AAC55212.2022.10822933

PAPERS PRESENTED AT PROFESSIONAL MEETINGS

1. **M. Petrusky**, I.D. Boyd. A Novel Stagnation Streamline Model for Discrete-Velocity Simulation of Rarefied Hypersonic Flows. *AIAA Aviation 2025 Forum*, 2025. *Accepted*.

ABSTRACTS PRESENTED AT PROFESSIONAL MEETINGS

Not including papers listed above.

6. **M. Petrusky**, I.D. Boyd. Guidelines for Use of the Ambipolar Diffusion Approximation in Rarefied Hypersonic Flows. DSMC 2025 Conference, Santa Fe, NM, September 28-October 1, 2025. *Accepted*.
5. A.S. Gaikwad, I. Petrushina, I.V. Pogorelsky, K. Kusche, W. Li, K.G. Miller, E. Trommer, B. Romasky, **M. Petrusky**, et al. Field Mapping of CO₂-laser-driven LWFA at Low Density using Electron Beam Probing. 66th Annual Meeting of the APS Division of Plasma Physics, Atlanta, Georgia, October 7-11, 2024.
4. **M. Petrusky**, W.R. Chan, I.D. Boyd. Assessing the Ambipolar Diffusion Approximation for Rarefied Hypersonic Plasma Shock Layers. 65th Annual Meeting of the APS Division of Plasma Physics, Denver, CO, October 30-November 3, 2023.
3. **M. Petrusky**, I.D. Boyd. Direct Kinetic Modeling of the Plasma Generated in a Rarefied Hypersonic Shock Layer. 2023 International Conference on Plasma Science, Santa Fe, NM, May 21-25, 2023.
2. **M. Petrusky**, T. Ye, C. Ghosh, A. Deshpande, K. Kumar. Determining the Position Dependency of Cherenkov Radiation in Quartz. American Physical Society Conference for Undergraduate Women in Physics, Philadelphia, PA, January 19, 2020.
1. **M. Petrusky**, T. Ye, C. Ghosh, A. Deshpande, K. Kumar. Determining the Angular Dependency of Cherenkov Radiation in Quartz. Scientista Symposium Poster Competition, Boston, MA, March 30, 2019.

SEMINARS AND TALKS

5. “Evaluation of Charged Species Diffusion in Hypersonic Flows”, RGD NextGen Talks, online, June 18, 2025.
4. “Charting Your Course In Undergrad”, Honors Alumni Speaker Series, Stony Brook University, online, March 5, 2025.
3. “Modeling Plasma Dynamics during Hypersonic Entry”, 2024 Future Leaders in Aerospace Symposium, Stanford, CA, May 15-17, 2024.

2. “The Art of Flexible Science Communication”, AES Fluids-Structures-Materials Seminar Series, Boulder, CO, September 20, 2023.
1. “An Analysis of Academic Culture and its Impact on Young Professionals”, Symposium on Advancing Equity in Higher Education on Long Island, online, April 9, 2021.

FELLOWSHIPS, AWARDS, AND HONORS

2023	Micheal Springman Aerospace Graduate Fellowship Award, Smead Aerospace Engineering Sciences Department, University of Colorado Boulder.
2021	National Science Foundation Graduate Research Fellowship.
2021	John S. Toll Prize, Department of Physics and Astronomy, Stony Brook University.
2020	Undergraduate Recognition Award for Outstanding Achievement in Community Service, Stony Brook University.
2020	Sigma Pi Sigma, American honor society for physics and astronomy.
2018	Explorations in STEM–PSEG Scholar, Stony Brook University.

SOFTWARE DEVELOPMENT

- ♦ **Direct Kinetic Code (DK)**: Uses discrete-velocity method to solve Boltzmann-Poisson-BGK equations for discretized probability density function. Added 1D3V dimensionality; implemented Parallel Kinetic Perpendicular Moment method. Primary maintainer from 2023 to present.
- ♦ **Data Parallel Line Relaxation Code (DPLR)**: Suite of CFD tools for simulation of supersonic and hypersonic flows in chemical and thermal nonequilibrium by NASA. Developed viscous shock solving capabilities for DPMARCH, a 1D shock space marcher in DPLR.
- ♦ **Stochastic PArallel Rarefied-gas Time-accurate Analyzer (SPARTA)**: Direct Simulation Monte Carlo code by Sandia National Labs. Added test case for Sod shock tube.
- ♦ **Quasi-static Electron Propagation Code (QuEP)**: 3D3V Monte Carlo solver which advects charged particles through static electromagnetic fields. Publicly available on GitHub.

TEACHING

CU Boulder

Spring 2025	ASEN 5151: Fundamentals of Gas Dynamics. Sole graduate teaching assistant, 50 students.
Summer 2023	ARSC 3700: McNair Seminar: Research Design. Instructor of record, re-designed course, 10 students.
Summer 2022	ARSC 3700: McNair Seminar: Research Design. Co-graduate teaching assistant, 16 students.

Pedagogy Training

Spring 2025	Dialogic Pedagogy of Practice Program, CU Dialogues Program and the Center for Teaching and Learning, Boulder, CO.
Fall 2024	DEI-Informed Dialogic Pedagogy Micro-Credential, CU Dialogues Program and the Center for Teaching and Learning, Boulder, CO. Badge issued via Credly.
Spring 2019	JRN 365: Talking Science, School of Communication and Journalism and the Alan Alda Center for Communicating Science, Stony Brook, NY.

PROFESSIONAL SERVICE

Professional society memberships

- ♦ American Institute of Aeronautics & Astronautics

2025	Volunteer, Girls Exploring Science, Technology, Engineering, and Math (GESTEM).
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- ♦ American Physical Society

2022 Guest Physicist, Physicist-to-Go Program.

Symposia

2025–Present Committee Member, International Symposium on Rarefied Gas Dynamics
Next Generation (RGD NextGen)

Service at University of Colorado Boulder

Fall 2024 Volunteer, Aerospace Boot Camp Seminar Series.
2023, 2024 Fall Admissions MS Application Review Committee, Aerospace Engineering
Sciences (AES) Department.
2021–2024 Graduate Student Mentor, McNair Scholars Program.
2021–2023 Inclusive Culture Committee, AES Department.
2021–2023 Diversity, Equity, and Inclusion Chair, Aerospace Graduate Student Government.
Fall 2022 Lead, Aerospace Engineering Sciences PhD Applicant Mentoring Pilot Program.
Spring 2022 Critical Needs Faculty Search Committee, AES Department.

Service at Stony Brook University

2018–2021 Vice President, Stony Brook Society of Physics Students chapter.
2018–2020 Peer Mentor, Women in Science and Engineering Honors College.

SELECT WORKSHOPS AND VISITS

4. University of Colorado – Rocky Mountain Advanced Computing Consortium AI Workshop, Boulder, CO, August 5-6, 2025.
3. Plasma Communication and Assessment Tools for Public Engagement Workshop (PNET25), Morgantown, WV, June 1, 2025.
2. Future Leaders in Aerospace Symposium, Stanford, CA, May 15-17, 2024.
1. US ITER Research Program Research Needs Workshop, online, February-April 2022.